

- (c) the expected waiting time of a truck in the system.
- (d) the expected waiting time of a truck in the waiting line.
- (e) The probability that a truck has to wait for service.
- (f) the probability that there is no truck in the system.

APRIL/MAY 2024

23PECM14B — OPERATIONS RESEARCH

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.



1. Write any two characteristics of operations Research.
2. Define unbounded solution.
3. What do you mean by an unbalanced T.P?
4. State the meaning of an unbalanced assignment problem.
5. Define a game.
6. What types of games are solve graphically?
7. Give the meaning of group replacement.
8. What is the critical path?

9. Give the meaning of queue.

10. Explain Bayesian rules.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Explain the uses and limitations of operations Research.

Or

(b) Solve the following linear programming problem

Maximize : $Z = 3x_1 + 2x_2$

Subject to the constraints :

$$3x_1 + 2x_2 \leq 6;$$

$$2x_1 + 3x_2 \leq 6;$$

$$x_1, x_2 \geq 0$$

12. (a) Explain the solutions to a transportation problem.

Or

19. A small maintenance project consists of the following 12 jobs whose precedence relation is identified with their node numbers:

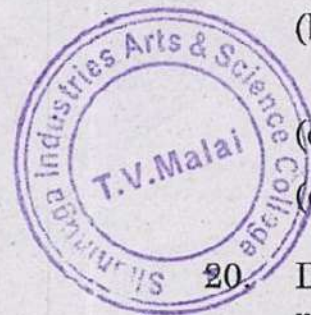
Job _{ij}	(1,2)	(1,3)	(1,4)	(2,3)	(2,5)	(2,6)
Duration (in days)	10	4	6	5	12	9

Job _{ij}	(3,7)	(4,5)	(5,6)	(6,7)	(6,8)	(7,8)
Duration (in days)	12	15	6	5	4	7

- (a) Draw an arrow diagram representing the project.
- (b) Calculate earliest start, earliest finish, latest start and latest finish time for all jobs.
- (c) Find the critical path and project duration.
- (d) Tabulate total float and independent float.

20. Data have been accumulated at a banking facility regarding the waiting time for delivery trucks to be loaded. The data show that the average arrival rate for trucks at the loading docks is 12 per hour. The average time to load truck is 20 minutes. Find

- (a) the expected number of trucks in the system.
- (b) the expected number of trucks waiting to be service.



17. There are four jobs to be assigned to five machines. Only one job can be assigned to one machine. The amount of time in hours require for the jobs per machine are given in the following matrix

Jobs	Machines				
	A	B	C	D	E
1	4	3	6	2	7
2	10	12	11	14	16
3	4	3	2	1	5
4	8	7	6	9	6

Find an optimum assignment of jobs to the machines to minimize the total processing time and also find out for which machine no job is assigned. What is the total processing time to complete all the jobs?

18. Solve the following game:

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

- (b) A machine operator processes five types of items in his machine each week and must choose a sequence for them. The set up cost per change depends on the item presently on the machine and the set-up to be made according to the following table

From Item	To Item				
	A	B	C	D	E
A	∞	4	7	3	4
B	4	∞	6	3	4
C	7	6	∞	7	5
D	3	3	7	∞	7
E	4	4	5	7	∞

If he process each type of item once and only one each week, how should be sequence the items on his machine in order to minimize the total start-up cost?

13. (a) Six jobs go first through machine I and then through machine II. The orders of completion of jobs have no significance. The following gives the machine times in hour, for six jobs and the two machines

Job	1	2	3	4	5	6
Machine I	5	9	4	7	8	6
Machine II	7	4	8	3	9	5

Find the sequence of the job that minimizes the total elapse time to complete the job.

Or

- (b) Explain the rule for game theory. State the types of games.
14. (a) The cost of machine is Rs.61,000 and its scrap value is Rs.1,000. The maintenance costs found from the past experiences are as follows:

Year	1	2	3	4
Maintenance cost in Rupees	1,000	2,500	4,000	6,000
Year	5	6	7	8
Maintenance cost in Rupees	9,000	12,000	16,000	20,000

When should the machine be replaced?

Or

- (b) For the following project, determine the Critical Path and its duration.

Activity	A	B	C	D	E	F	G	H
Predecessors	—	A	A	B	B	D,E	D	C,F,G
Time (days)	2	4	8	3	2	3	4	8

15. (a) In public telephone booth, the arrivals of an average are 15 per hour. A call on an average takes three minutes. IF there is just one phone, find
- the expected number of callers in the booth at any time
 - the proportion of the time, the booth is expected to be idle?

Or

- (b) State the advantages of decision tree approach.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. A manufacturers engage in producing two products X and Y the contribution margin being Rs.15 an Rs.45 respectively. A unit of product X requires unit of facility A and 0.5 unit of facility B. A unit of product Y requires 1.6 units of facility A, 2.0 units of facility B and 1 unit of raw-material C during a particular time period are 240, 162 and 50 units respectively. Using the simplex method find out the product mix that will minimize the contribution margin.